GOVERNMENT OF INDIA
ATOMIC ENERGY
LOK SABHA

UNSTARRED QUESTION NO:1686
ANSWERED ON:09.12.2015
Thorium for Nuclear Power Generation
Patle Smt. Kamla Devi

Will the Minister of ATOMIC ENERGY be pleased to state:

(a)whether indigenous technology has been developed for usage of thorium for nuclear power generation in this country;

(b)if so, the details thereof; and

(c)the names of the countries where the said technology has been developed fully?

Answer

THE MINISTER OF STATE FOR PERSONNEL, PUBLIC GRIEVANCES & PENSIONS AND PRIME MINISTER'S OFFICE (Dr. JITENDRA SINGH) :

(a)&(b) Yes, Sir. In preparation for the Third Stage of India's Nuclear power programme, development of technologies pertaining to utilisation of thorium has been a part of ongoing activities in Department of Atomic Energy (DAE). With the sustained efforts over the years, India has gained experience over the entire thorium fuel cycle - irradiation, fabrication and reprocessing on a semi-industrial scale. Efforts are currently on to enlarge this experience to industrial scale. Bhabha Atomic Research Centre (BARC) and other research organisations attached with DAE are engaged in various R&D activities to address the utilisation of thorium in different types of reactors. Some of the key technologies developed as part of the Thorium utilisation programme are described below :

(i) Technologies for mining of monazite and its processing to extract thoria (ThO2) have been well established. Several thousand tonnes of monazite sand have been processed to extract thoria.

(ii) Technologies for Thorium fuel fabrication through powder pellet route have been established. Few tons of fuel was made for use in research reactors CIRUS and Dhruva, Pressurised Heavy Water Reactor (PHWR) and for blanket assemblies for Fast Breeder Test Reactor (FBTR). Few pins were also fabricated using mixed oxides of (Th-Pu) for irradiation in research reactors.

(iii) The fabricated fuel has been irradiated in the research reactors CIRUS, Dhruva, and FBTR. Thoria bundles have also been used in the initial cores of six units of Pressurised Heavy Water Reactors (PHWRs). The irradiation experience of thoria fuel in these reactors and test irradiations are satisfactory.

(iv) The thoria pins irradiated in CIRUS reactor, BARC have also been reprocessed to obtain Uranium 233. The recovered Uranium 233 has been fabricated as fuel and used in 30 kWth KAMINI Research Reactor, which has been in operation since 1996 at Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam. Some of the Thoria bundles irradiated in PHWRs have also been reprocessed in the recently commissioned PRTRF (Power Reactor Thoria Reprocessing Facility) at BARC and Uranium 233 has been obtained.

(v) Studies have been also carried out to use thorium in different types of reactors with regard to fuel management, reactor control and fuel utilisation.

(vi) A Critical Facility for Advanced Heavy Water Reactor was commissioned in 2008 at BARC and is being used since then for carrying out experiments to further validate the physics design features of Advanced Heavy Water Reactor (AHWR).

(vii) To accelerate thorium utilisation and to demonstrate industrial scale use of Thorium in our power programme, BARC has designed an indigenous Advanced Heavy Water Reactor (AHWR) to serve as a technology demonstrator. This 300 MWe reactor is specially meant for demonstration of large scale commercial utilisation of Thorium, generating nearly 60% of its power from in-situ burn up of Thorium. The design of all nuclear systems of the reactor has been completed and associated confirmatory R&D is on. Detailed engineering is in consultancy mode

(c) During the period of 1960s to late 1980s countries viz. USA, Germany and UK worked on utilisation of Thorium mainly for use in Gas Cooled Reactors and Light Water Reactors (LWRs). However, once the Light Water Reactor (LWR) technology was well established with enriched Uranium, R&D on Thorium was terminated in other countries except in India. India has continued to develop technologies for Thorium and Thorium based reactors as part of our three stage nuclear power programme.
Recently, many countries like China, USA, France, Russian Federation and Czech Republic have restarted technology development for Thorium utilisation. A majority of them including India are developing technologies for Molten Salt Breeder Reactors. These are novel technologies, involving several challenges and are, therefore, still under development.

*****